**Dental metaral**

Temporary Filling Materials

**Indications**
1. During treatment of root canal fillings.
2. It should be placed after inlay and onlay preparation until the final restoration is placed.
3. After pulp capping in case of traumatic exposure, to give time for pulp healing process and production of dentin.
4. Pedodontic practice.

**Requirements**
1. Should be easily removed from the cavity
2. Should have sedative effect to the tooth and promote pulp healing
3. Reasonable strength and abrasive resistance
4. Radiopaque
5. Reasonable setting time and has low flow after setting

**Types**
1. Zinc oxide eugenol
2. Zinc phosphate
3. Zinc silico phosphate
4. Gutta-percha

1. **Zinc oxide eugenol**
   It's the material of choice as temporary filling.
   **Powder:** zinc oxide, zinc acetate
   **Liquid:** olive oil
   Mixing is according to manufacture instruction or pastes.

**Properties:**
- It has sedative effect on the tooth; reasonable sealing of the cavity, but it has low strength, low abrasive resistance, and low flow after setting.
- The strength and abrasive resistance could be improved by adding 20-40% of fine polymer particles and treating the surface of zinc oxide particles with carboxylic acid-reinforced type.
- Sufficient powder should be added to the liquid to achieve putty consistency.

2. **Zinc phosphate**
   It is powder and liquid.

**Properties:**
- Has higher strength and abrasive resistance than ZOE and has relatively low solubility in oral fluids but still has low abrasive resistance in area subjected to high load of mastication.
- Higher powder/liquid is required to decrease acidity and increase strength.
• Reinforced zinc phosphate is more durable and could be used when longer time is required.

3. Zinc silico phosphate

*Powder:* zinc oxide and silicate glass  
*Liquid:* phosphoric acid  

**Properties:**  
• It causes fluoride release  
• It has superior strength and more translucent than zinc phosphate  
• Not promotes healing of the pulp  
• Used when longer time is required for temporary filling.

4. Gutta-percha

It is composed of natural gutta-percha, zinc oxide, wax, resin, metal salts to give radiopacity  
It is applied by softening the gutta-percha on the flame and put it inside the cavity.  

**Disadvantages**  
1. Lack the ability to seal the cavity lead to micro leakage  
2. Heat cause pain to the patient  
3. Low strength, so reinforced zinc phosphate is more durable and could be used when longer time is required.

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**Composite Resin**

• The term composite refers to three-dimensional combination of at least two chemically different materials with a distinct interface separating the components.  
• Composite filling is a polymeric restorative material reinforced with filler particles.  
• Composite resin was developed first by Bowen in 1962 to overcome the shortening in physical properties of unfilled resin and silicate. It is the most popular tooth colored restorative materials.

**Composition**  
**1- Resin Matrix**

The nature of resin may alter slightly from one product to another, essentially, they all contain **dimethacrylate monomer**, like Bis- GMA (Bis phenol-A & glycidyl methacrylate) or UDMA (Urethane dimethacrylate), Bis - GMA and UDMA are viscous and sticky so , **TEGMA** (Triethylene glycol dimethacrylate) a low molecular weight **monomer** added as a dilute to control the consistency of composite paste. Bis-GMA, UDMA and TEGMA are characterized by carbon double bond the react to convert them to polymers.  

**2- Fillers**

• They are silicate particles in two forms crystalline forms (quartz) and non crystalline form (glass like aluminosilicates and borosilicates), the type of filler, particle size, and distribution in resin matrix are the major factors controlling properties.  
Zinc, Barium, Zirconium ions may be added to produce radiopacity in the filler particles.
- The quartz filler is harder than glass fillers but difficult to polish to the smooth surface.

**Advantages of adding fillers**

1- Polymerization shrinkage is reduced, as compared with unfilled due to less resin is present in a composite. Although shrinkage is varies from one product to another.
2- Water sorption and coefficient of thermal expansion are significantly reduced.
3- Mechanical properties such as compressive strength, tensile strength, abrasive resistance and modulus of elasticity are improved.
4- Optical properties such as color match and radiopacity are improved.

**3- Coupling agent**

Organosilanes are added to bond the filler particles to the resin matrix, so stresses are transferred to the stiffer filler particles through the weaker resin.

Advantages:
1- Improve the mechanical properties of the composite resin.
2- Prevent the fillers from being dislodged from the resin matrix.
3- Hydrolytic stability prevents the water from penetrating along resin - filler interface.

**4-Initiator - Activator System:**

**a) Self cured composite resin**

Two paste system: one paste contains 1% benzoic peroxide initiator second paste contain 0.5 % of tertiary amine activator.

Reaction leads to formation of free radical, which will initiate polymerization.

**b) Light activated composite resin**

One paste system

The first light cures system made use ultraviolet radiation to initiate polymerization. Then UV light is then replaced with visible light cure system, which is safer, less expensive and improve ability to polymerize thicker increment up to 2 mm. Photoinitiator is added to initiate polymerization, it absorbs visible light of wavelength (400-500 nm) (blue light) forming free radical which initiate polymerization.

**c) Laser activated system**

Photochemical initiator found to initiate polymerization when subjected to Argon laser (456- 495 nm) wavelength energy. This provides curing up to 10 mm form the tip over a large focusing area and it can produce a complete curing in only 8 seconds.

**5- Inhibitors**

Butylated hydroxytoluene (0.01 /wt) inhibitor is added to prevent spontaneous polymerization of monomers they have strong reactivity potential with free radicals that has been formed by brief exposure to light when the material are dispersed.

**6- Pigments**
Inorganic oxide like aluminum oxide or titanium oxides are added in small amount to provide shades that match the majority tooth shades.

**Systems of composite resins**
1- **Two paste** system (chemical cure)
2- **One paste** system (light cure)
3- **Powder and liquid system:**
   Powder: filler, peroxide initiator.
   Liquid: monomer, chemical activator.
4- **Paste and liquid system:** difficult to mix.
   Paste: monomer, filler, peroxide.
   Liquid: monomer, chemical activator.
5- **Encapsulated system:** filler, peroxide mixed initially and separated from monomers which contain chemical activator, on breaking the seal separating the 2 parts the reactive compounds come into contact and mixed mechanically.

**Manipulation**
Proper isolation to prevent bacterial infiltration, placement of protective liner or base? (should not contain eugenol?)

1- **Acid etching**
Since the material is not adhering to the tooth, so acid etching is used to provide micro-mechanical retention for resin restoration to the tooth surface.
The technique is consisted of applying 30-50 % (37%) phosphoric acid to enamel for 30-60 seconds followed by thorough rinsing and drying the area. The acid solution will remove the enamel prisms lead to numerous of microscopic undercuts and irregular peaks in enamel.
- Bonding agent applied (low viscosity monomer) flows into the minute undercuts and polymerized to form resin tags.
- For the dentin acid etching using phosphoric acid (37%) for 10-30 seconds. Followed by application of primer (an adhesion promoting agent), hydrophilic resin, added to ensure optimum wetting and prevent collapse of collagen fibers. Then dentine bonding agent is applied.

2. **Application of composite**
   - For **self cure** : equal amount of catalyst and base (pastes) are placed on the pad first, then mixed for 30 seconds using plastic spatula till get homogenous mass. Than placed inside prepared cavity holding a matrix strip (polyester strip) till it sets.
   - For **light cure** select proper shade, add composite by increments each increment should not exceed 2 mm thickness; each increment should be cured with light cure for 20-60 seconds according to the manufacturer instruction.

**Advantages matrix strip**
A) Protect filling from air (because the filling is oxygen sensitive)
B) Pressing the filling with matrix strip to ensure flow of the material inside cavity.
C) To prevent direct contact with adjacent teeth.

**Advantages of light cure**
A) Color stability
B) Resistance to wear
C) No incorporation of air bubbles.
D) Longer working time.

**3-Finishing:**
Composite resin cured against matrix strip provides maximum smoothness. Finishing of composite (using finishing burs) after setting to remove access material and contouring of the filling material leads to surface roughness, (the weaker resin matrix wear away leaving a filler particles protruded from the surface).
After finishing, polishing of the surface should be accomplished to reduce surface roughness because rough surface leads to plaque retention, staining and recurrent caries.